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PLASTIC CONTAINER

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Claim

A type of plastic container characterized by the following facts: a composition consisting of 20-80 wt% of a propylene-based resin and 80-20 wt% of a flake-shaped inorganic filler is molded into a sheet with thickness of 0.2-1.5 mm; the sheet is pretreated with corona discharge; printing is performed on the treated surface; and punching processing is performed to form the plastic container; for this plastic container, the reflectivity of said treated surface of sheet is at least 50%.

Detailed explanation of the invention

Objective of the invention

This invention pertains to a type of printed plastic container. More specifically, this invention pertains to a type of plastic container manufactured as follows: a propylene-based resin composition containing flake-shaped inorganic filler is molded into a sheet; corona discharge is performed for the sheet; printing is performed on the sheet; and punching processing is carried out to form the plastic container. The printing is vivid, and the secondary adhesiveness is good for the plastic container.

Background of the invention

In the prior art, packing containers for frozen foods, detergent powder, and other substances that require a waterproof condition are prepared as follows: wax or the like is applied to cardboard to make it waterproof, or low-density polyethylene is laminated on said cardboard to make it waterproof; then, printing and punching processing are carried out, followed by assembly to form the packing container. However, when said waterproof cardboard is used, warping may occur and the dimensions may change due to moisture. Consequently, when multicolor printing is carried out, color deviation may occur. This is undesired. In order to solve this problem, the use of propylene, polyethylene or other plastic sheet has been proposed to construct a container. However, even when the temperature varies a little, warping occurs. This is undesired. In order to prevent this problem, an annealing device should be installed. As a result, the cost increases. Also, because assembly is performed after punching, the sheet has directionality, and plastic deformation is difficult. Consequently, it is difficult to obtain the desired shape. Then, warping and twisting may occur. This is undesired. In addition, when offset

gravure printing is performed on a surface with a low surface reflectivity, it is impossible to realize a vivid print. Due to this problem, the commercial value decreases.

Constitution of the invention

In order to solve the aforementioned problems, the present inventors have performed extensive research. As a result of this research, it was found that a plastic container with the following features can solve the aforementioned problems:

A composition consisting of 20-80 wt% of a propylene-based resin and 80-20 wt% of a flake-shaped inorganic filler is molded into a sheet with thickness of 0.2-1.5 mm; the sheet is pretreated with corona discharge; printing is performed on the treated surface, and punching processing is performed to form the plastic container; for this plastic container, the reflectivity of said treated surface of the sheet is at least 50%.

As a result, this invention was achieved.

Effect of the invention

For the plastic container prepared in this invention, the following effects (characteristic features) can be displayed.

- (1) It is possible to form a vivid print.
- (2) The secondary-adhesiveness of the printing ink is excellent.
- (3) There is no warping or twisting of the sheet or container.
- (4) The water resistance is good.
- (5) The dimensional stability with respect to temperature is good.

The plastic [container] of this invention having the aforementioned effects can be used in the following typical applications:

- (1) Packing container for frozen foods
- (2) Packing container for detergent powder
- (3) Packing container for makeup
- (4) Packing container for ice cream
- (5) Packing container for butter, margarine, cheese, etc.

Specific explanation of the invention

A. Propylene-based resin

The propylene-based resin used in this invention refers to propylene homopolymer or a random or block copolymer made of propylene and ethylene and/or other α -olefin having a carbon number up to 12 (with the copolymer proportion of the sum of ethylene and other α -olefins up to 20 wt%). For the propylene-based resin, the melt flow index (as defined in JIS.

K-6758, measured at 230°C under a load of 2.16 kg, referred to as "MFI") is usually in the range of 0.01-50 g/10 min, or preferably in the range of 0.1-20 g/10 min, or more preferably in the range of 0.1-10 g/10 min. If the MFI of the propylene-based resin is smaller than 0.01 g/10 min, the moldability of the sheet will be poor, and it will be difficult to obtain a sheet with a uniform thickness. On the other hand, if a propylene-based resin with MFI exceeding 50 g/10 min is used, the melt tension of the sheet will be insufficient, and it will be difficult to obtain a sheet with a uniform thickness, and the obtained sheet will not have sufficient impact strength.

Said propylene-based resin is prepared by means of homopolymerizing propylene or random or block copolymerizing propylene with ethylene and/or other α -olefin in the presence of a catalyst (the so-called Ziegler Natta catalyst) prepared from an organometallic compound (such as an organic aluminum compound) and a supported carrier type catalyst prepared from a transitional metal compound (such as a titanium-based compound) or by supporting the transitional metal compound on a carrier (for example, magnesium-based compound, or other treated substance).

B. Flake-shaped inorganic filler

For the flake-shaped inorganic filler used in this invention, the average particle size should be 20 μ m or smaller, or preferably 10 μ m or smaller, or more specifically in the range of 0.5-7.0 μ m. If a flake-shaped inorganic filler with average particle size over 20 μ m is used, the obtained sheet and container will have a poor impact strength, and, in thermal molding, the draw-down amount will be large, and the thickness of the molding will be significant. This is undesired. The average aspect ratio should be in the range of 3-20, or preferably in the range of 3-15, or more preferably in the range of 5-13. If the average aspect ratio is smaller than 3 for the inorganic filler used, the obtained sheet or container will lack rigidity, and this is undesired. On the other hand, if the average aspect ratio of the flake-shaped inorganic filler is over 20, it will be difficult to maintain the shape of the flake-shaped inorganic filler, and the flake-shaped inorganic filler will break during blending. Typical examples of inorganic fillers include talc, mica, glass flakes, graphite, etc. Among them, talc and mica are preferred.

C. Manufacturing of the composition (mixture)

For the composition of this invention, the proportion of said flake-shaped inorganic filler should be in the range of 20-80 wt%, or preferably in the range of 20-70 wt%, or more preferably in the range of 30-70 wt%. If the proportion of the flake-shaped inorganic filler is less than 20 wt%, the rigidity of the sheet will be insufficient, and warping will occur with changes in temperature. On the other hand, if the proportion is over 80 wt%, the fluidity of the composition

will decrease significantly, and it will be impossible to obtain a sheet with a uniform thickness, and even when a sheet is obtained, the impact strength will be insufficient.

When the composition of this invention is manufactured, the propylene-based resin and flake-shaped inorganic filler are mixed uniformly, so that the purpose can be realized. That is, the composition of this invention can be prepared by blending the components using a mixer commonly used in this industry, such as a Henschel mixer or other mixer for dry blending, or a Banbury mixer, kneader, roll mill, screw extruder or other mixing machine for melting blending. In this case, one may first perform dry blending, and then the obtained composition (mixture) may be melt blended to obtain an even more homogeneous composition. In this case, usually, after melt blending, pelletization is performed to form pellets for use in the later molding step.

When the composition of this invention is manufactured, one may mix all of the components of the composition at the same time. Also, one may mix a portion of the components beforehand to form a masterbatch, and then mix the remaining components into the obtained composition (masterbatch). In short, when the composition of this invention is manufactured, components in amounts corresponding to the aforementioned composition are blended to form an overall homogeneous mixture to realize the aforementioned purpose.

When the composition of this invention is manufactured, the composition may be prepared from a propylene-based resin and flake-shaped inorganic filler. However, as needed, one may also add commonly used stabilizers against heat, light (UV light) and oxygen, flame inhibitor, lubricant, processability improving agent, static inhibitor, and other additives as long as the aforementioned effects (characteristic features) are not hampered.

D. Manufacturing of the sheet

The composition prepared in the above is molded into a sheet using any of the following methods conventionally adopted in the industry of synthetic resins: T-die method, blow method, calendaring method, etc. In any case, for the obtained sheet, the reflectivity of at least one side of the sheet should be at least 50%. If the reflectivity of the sheet is lower than 50%, it will be impossible to obtain a container with a vivid print on it. As a method for obtaining a sheet with a reflectivity at least of 50%, usually, the sheet-like object in a melt or semimelt state is fed between a pair of pressing rolls finished to a mirror surface quality (both rolls may be metal rolls, or one of the two rolls can be a heat resistant rubber roll). However, there is no special restriction on the specific manufacturing method in this invention (inline or offline method may be used), as long as the reflectivity of at least one surface is 50% or higher.

For the sheet prepared in this way, the thickness should be in the range of 0.2-1.5 mm, or preferably in the range of 0.2-1.2 mm, or more preferably in the range of 0.2-1.0 mm. If the thickness of the sheet is [smaller than] 0.2 mm, rigidity will be insufficient, and the ability to

hold contents in the container will be poor. Also, it will be difficult to process ruled lines for forming the container (such as a box). On the other hand, if the thickness is larger than 1.5 mm, although ruled lines can be processed, molding will be difficult, and a good container will not be obtained.

Both said melt blending operation and molding operation should be performed at a temperature higher than the softening point of the propylene-based resin used. However, when the temperature is higher than 280°C, the propylene-based resin will partially thermally decompose. Consequently, it is necessary to perform said operations at a temperature lower than 280°C.

H. Corona treatment

When corona treatment is performed for the sheet manufactured as above, usually, the same method of treatment as that of corona treatment of the synthetic resin may be used. The following is a typical treatment method: a ground roll covered with polyethylene terephthalate, silicon or other dielectric and an arc-shaped or rod-shaped plate electrode are installed with a gap at 0.5-2 mm between them, and corona discharge with power of 100-1000 W is performed in this gap, while said sheet is fed through the gap. This treatment can be performed for both sides of the sheet. Also, it may be performed during the sheet manufacturing operation or, in some cases, as another step after the sheet is wound up (such as the step in which the sheet is slit to an appropriate width, or the printing step). In addition, it is also possible to perform the treatment in a combination of these steps. The effect of the corona discharge is evaluated by means of the wet tension. If the wet tension is over 34 dyne/cm, it is considered as passed.

F. Printing, punching, formation of container

For the treated sheet obtained in the above, printing may be performed using an oil-based printing ink for the propylene-based resin on the surface that has a reflectivity of 50% or higher, such as offset printing, letterpress printing, or gravure printing. As a result, an attractive print is obtained. For the sheet printed in this way, punching is performed to a shape for making a container by means of a conventional knife mold. In addition, ruled lines are formed during the punching operation. For the printed and punched sheet prepared as above, a container is prepared by bonding by means of an adhesive (e.g., rubber-based adhesive, hot melt-based adhesive). In this way, the packing container of this invention is formed.

Application examples and comparative examples

In the following, this invention will be explained in detail with reference to application examples.

In the application examples and comparative examples, the wet tension was measured according to JIS K-6760. Rigidity was measured at a drawing speed of 5 mm/min according to JIS K-6768, and it was evaluated by means of Young's modulus. In addition, the reflectivity was evaluated by means of gloss as defined in JIS Z-8701. The vividness of printing was evaluated as follows: After spots (diameter of 0.08 mm) were printed at a density of 5 spots/mm using an offset plate, the presence of voids in the printing was evaluated at a magnification of 50X. In addition, for evaluation of the adhesiveness of the printing ink, checkerboard-pattern separation test was performed. In the checkerboard-pattern separation test, a checkerboard pattern was cut in 100 squares, 1 mm square, by means of the cutter. Then, an adhesive tape (made by Nichiban K.K.) was applied and completely bonded by finger pressure. Then, the adhesive tape was peeled off, and the results were inspected.

The properties of the propylene-based resin and flake-shaped inorganic filler used in the application examples and comparative examples are as follows.

Propylene homopolymer

As a propylene-based resin, propylene homopolymer (referred to as PP(1)) with density of 0.900 g/cm³ and MFI of 0.5 g/10 min was used in the test.

Ethylene-propylene block copolymer

As a propylene-based resin, propylene-ethylene block copolymer (referred to as PP(2)) with ethylene content of 10.5 wt%, MFI of 0.7 g/10 min and density of 0.900 g/cm³ was used.

Ethylene-propylene random copolymer

As a propylene-based resin, an ethylene-propylene random copolymer with density of 0.900 g/cm³ (with content of ethylene of 3.0 wt%, MFI of 0.8 g/10 min, referred to as PP(3)) was used.

Flake-shaped inorganic filler

The types of flake-shaped inorganic filler used in the test include talc with aspect ratio of about 7 (average particle size of 3 μm) and mica with aspect ratio of about 8 (average particle size of 3 μm).

Application Examples 1-5, Comparative Examples 1-3

The aforementioned propylene-based resin and flake-shaped inorganic filler in amounts listed in Table 1 (by weight) were dry blended for 2 min using a Henschel mixer. Each obtained mixture was blended and pelletized using a vent-equipped biaxial extruder (diameter of 75 mm).

The obtained pellets were used to form a sheet with thickness of 0.4 mm by means of an extruder (diameter of 63 mm) equipped with T-dies at a resin temperature of 240°C. In this case, the melt sheet output from T-dies was fed between a pair of metal rolls whose surfaces were finished to a mirror surface quality (with roll surface temperature at 80°C) and which were set to process a 0.4-mm-thick sheet. Then, the sheet was cooled. The sheet was then subject to corona treatment using a corona treatment machine (manufactured by Pillar Co., solid-state system, model of TST-5) set at output of 120 V and 7 A (this corona treatment was not performed in Comparative Example 3), followed by winding. In addition, the obtained sheet was gravure printed using an ink for propylene-based resin (product of Tokyo Ink Co.), and the sheet was then punched into the shape for forming the container using a knife mold. Table 1 lists the MFI data of the pellets, as well as tensile Young's modulus, reflectivity and wet tension of the obtained sheets. As far as the vividness of printing is concerned, in all of the application examples and Comparative Example 2, no deviations or voids were observed in printing. However, in Comparative Examples 1 and 3, deviations and voids were observed in printing. In the checkboard peeling test, in all of the application examples and Comparative Examples 1 and 2, no separation of the printing ink was observed. However, in Comparative Example 3, all of the ink was separated. In addition, after punching into sheets to form a box, the sheets were placed in a gear oven at 50°C for 1 h. In all of the application examples and Comparative Examples 1 and 3, no warping or deformation was observed. On the other hand, in Comparative Example 2, serious warping and deformation took place.

Table 1

① 試料名 材料名	② 成形条件		③ 成形条件		④ MFI (g/10分)	⑤ 引張強度 (N/cm)	⑥ 伸率 (%)	⑦ 引張力 (N/cm)
	②-1 温度	②-2 速度	③-1 温度	③-2 速度				
⑧ 実施例 1	240	10	240	10	2.5	21000	15	15
2	240	10	240	10	2.5	21000	15	15
3	240	10	240	10	2.5	21000	15	15
4	240	10	240	10	2.5	21000	15	15
5	240	10	240	10	2.5	21000	15	15
⑨ 比較例 1	240	10	240	10	2.5	21000	15	15
2	240	10	240	10	2.5	21000	15	15
3	240	10	240	10	2.5	21000	15	15

Key: 1 Application Example or Comparative Example No.

- 2 Propylene-based resin
- 3 Type
- 4 Amount added (parts by weight)
- 5 Flake-shaped inorganic filler
- 6 Type
- 7 Amount added (parts by weight)
- 8 MFI (g/10 min)
- 9 Tensile Young's modulus
- 10 Reflectivity
- 11 Wet tension (dynes/cm)
- 12 Application Example
- 13 Comparative Example
- 14 Talc
- 15 Mica

As can be seen from the results of the aforementioned application examples and comparative examples, for the plastic container of this invention, the printing property, rigidity, dimensional stability, and waterproof property are excellent. Consequently, it can be used as a substitute for cardboard conventionally used as packing containers for frozen foods (e.g., frozen cakes, hamburgers), detergent powder, Japanese wine, milk, butter, margarine, cheese, makeup, ice cream, etc.